

it appears that the selection in the two groups did not affect the accuracy of the estimate of mean haemoglobin levels. It is possible that the group of W.A.A.F. which entered the Service some time ago might be differently constituted as regards social status, etc., from those which were entering later. The results for the new entrants are, however, similar to those of other groups of the population (M.R.C. report, 1944), and it seems very unlikely that earlier entrants could have had haemoglobin levels so much higher. Furthermore, the haemoglobin levels of the 40 girls of this group retested after ten months were by that time similar to those of other groups of more than six months' service.

Accuracy of Results.—Errors in the estimation of haemoglobin by the method used in this survey arise from three sources: inaccuracies in the apparatus, errors in collecting the sample of blood, and the error in matching. The apparatus was standardized and the appropriate correction applied to all readings. These corrected values are those given in the Table. The error in collection has been estimated by collecting samples from the ear and vein of 25 subjects and measuring the haemoglobin level in the usual way. This test showed that the samples from the ear were approximately 4.2% higher than those from the vein. It is probable that the levels as estimated from venous blood are more accurate. The error in matching was assessed by a test instituted by the Haemoglobin Survey Committee. The full results of this test are published in the report of the Committee; it may be stated, however, that I tended to read too low, as did most of the others taking part. The average correction to be applied in the ten samples estimated was approximately +4.4%. It is probable that a similar correction may be applied to all the results given in this report. The errors in collection and matching are similar in size but tend to alter the true values in opposite directions, so that the results given in the Table may be taken as being about the true values. The retesting of the 40 girls in Group 1 was carried out after the results of the matching test had been made known, and it was possible, therefore, that this error was being unconsciously corrected at the second test. A further 194 girls who had just come into the Service were therefore tested. The mean haemoglobin value of this group was 96.15 (standard deviation 10.0), which is not significantly different from that of the girls in Group 1 (difference 1.31 ± 0.817). It appears likely, then, that the error in matching was not being corrected and that the improvement in the 40 girls was real.

Normal Haemoglobin Values.—The mean haemoglobin level reached after six months' service is higher than any of the levels usually regarded as normal. The figure given by Price-Jones (1931) is 98.3%, and this has usually been accepted as the best estimate of normal averages. On the other hand, the value reached by the W.A.A.F. after six months' service (103% approximately) is well maintained without further improvement. This would suggest that the normal value is at least as high as this. It is possible that some of the W.A.A.F. with low values might not be consuming much of the Service diet and might be capable of showing further improvement; this would tend to make the mean value even higher.

Cause of Improvement.—The improvement is probably largely due to the high iron intake of women in the Service. The average intake per person per day is about 35 mg. (see Macrae, 1944); much of this iron comes from iron cooking vessels, which are rarely used in domestic cookery. What part is played by the intake of much protein of high biological value is not known, but there is little evidence of deficient intake of protein in the general population (H.M.S.O., 1944). It is doubtful if vitamin C intake plays any part in the improvement. The average ascorbic acid intake of W.A.A.F. personnel is about 25 mg. a day in the autumn and about 18 mg. a day in the spring (Macrae, 1944). It is probably at least as high among civilians, because domestic cooking methods are on the whole less destructive of this vitamin. Some slight improvement in average values may be due to the medical treatment of a few W.A.A.F. with low haemoglobin who develop symptoms during Service life.

Summary

The haemoglobin levels of W.A.A.F. personnel entering the service is about 95% (standard deviation 9.22) on the standard

Haldane scale. The haemoglobin level after six months' service is about 103% (standard deviation 9.12). This level is reached in six months to a year and is maintained thereafter. The error in collection results in readings which average approximately 4.2% too high, and errors in matching in readings which average approximately 4.4% too low. Correction for both these errors thus leaves the readings as given in the Table. It is probable that the "normal" mean value of women of this age group is at least 103%.

The improvement is probably due mainly to the high iron intake of W.A.A.F. personnel.

I am indebted to the commanding officers and W.A.A.F. administrative officers of the stations concerned and the W.A.A.F. personnel who took part in the test for their co-operation; to Dr. Bradford Hill for advice concerning the plan of the experiment and in the analyses of the results; and to Dr. Davies, pathologist to the Royal Gloucester Infirmary, for granting me laboratory facilities during May and June, 1943.

APPENDIX

Copy of Proforma Used in R.A.F. Haemoglobin Survey

Name	No.	Serial No.
Date of joining W.A.A.F.	Age last birthday	
Home address	Married, Single, Widow	
Previous occupation and town of work		
Occupation of husband		
Mark with a cross the circumstances applicable before joining the W.A.A.F.		
a. Lived with family on civilian rations usually supplemented by regular meals (5 or more a week) at canteen or restaurant		
b. Lived with family on civilian rations usually supplemented by some meals (less than 5 a week) at canteen or restaurant		
c. Lived with family on civilian rations without supplementary meals as described or with some meals as follows (Give short description)		
d. Lived in hostel, institution, or other communal life as follows (Give short description)		
e. Other circumstances as follows (Give short description)		
Serious illnesses during past six months ("Serious illness" if confined to bed for a week or more)		
Were you a blood donor?		
No. of donations in past 2 years		
Date of last donation		
No. of previous pregnancies		
Date of end of last		

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Medical Memoranda

A Note on Red Hair, Rheumatism, Tuberculosis, and Bleeding

The question of rheumatism, red hair, and bleeding has been raised again in the *Journal* (July 1, 1944, p. 33), and the stimulating reply there given suggests that the following data are worth stating.

RED HAIR

Of late all patients with red hair who consulted me have been noted, and this report concerns 100 consecutive red-haired patients. The accompanying Table shows the conditions in which the red-haired were seen with any frequency. It is clear that only a small minority (6%) of patients with rheumatic fever had red hair. The 3% of pneumonia patients with red hair probably coincides with the incidence of red hair in the population dealt with. Hill and Allan (1929) found an incidence of 3.1% in London children. A larger series will be necessary before it can be affirmed that the incidence of red hair in rheumatic patients is substantially greater than that in pneumonia or in the general population.

Hill and Allan (1929) found that 6.4% of 562 rheumatic cases had red hair, but only 3.1% of 536 controls (percentages which I confirm). According to the contributor in the *Journal*, this difference in 500 patients is probably significant. Yet Hill and Allan concluded that there were no physical characteristics peculiar to rheumatic children, no doubt because they considered other colours of hair and also eye colour, and did not concentrate on red hair alone. Shrubbsall (1903) found that blond traits were associated with acute rheumatism and tonsillitis, and brunette traits with pulmonary tuberculosis and malignant disease. Yet pulmonary tuberculosis was the chief disease with red-haired sufferers among these 100 red-haired.

But in conformity with Shruballs I saw malignant disease in 2 red-haired patients only. It should be of value further to study the incidence of red hair in pulmonary tuberculosis, rheumatic fever, acute tonsillitis, purpura simplex, and epilepsy.

BLEEDING

The contributor to the *Journal* stated that he had no knowledge of any work on red hair and excessive bleeding. There is, however, evidence that rheumatic fever is associated with unusual (if not excessive) tendency to bleed. The tendency of rheumatic persons to nose-bleeding is discussed by Levine, Andren, and Homans (1930). Coburn (1933) found post-mortem evidence that rheumatic fever was associated with diffuse haemorrhagic changes. I (Davis, 1941, 1943) have given evidence of a special association between purpura simplex and rheumatism. I do not yet know whether this association is stronger in red-haired rheumatic subjects. Although many clinicians will have seen purpura in tuberculosis the association is relatively rare (Davis, 1943). It might also be worth while investigating this association in red-haired tuberculous patients.

Details of a Series of 100 Red-haired Patients (Diseases in which Red Hair was seen in more than 3 Patients)

Disease	Total Cases	Cases with Red Hair	Percentage of 100 Red-haired Patients
Pulmonary tuberculosis	296	23 (7.8%)	23
Rheumatic fever (past or present) ..	248	15 (6.0%)	15
Acute tonsillitis	162	12 (7.4%)	12
Pneumonia	270	8 (3.0%)	8
Purpura simplex	59	7 (12.0%)	7
Epilepsy	47	6 (13.0%)	6

COMMENT

Of 240 patients with rheumatic fever 6% had red hair, as against 3% of pneumonia patients and 7.8% of sufferers from pulmonary tuberculosis. Of a series of 100 red-haired patients, 15% were rheumatic, 23% were tuberculous, and 12% had acute tonsillitis. There is a special association between rheumatism and purpura.

I thank Mr. J. R. M. Whigham, F.R.C.S., and the staff of St. Andrew's Hospital for their help.

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Intussusception after Appendicectomy

The following case is recorded as a rare instance of intestinal obstruction after operation.

An otherwise healthy boy was admitted on June 22, 1944, suffering from abdominal pain and vomiting of 12 hours' duration. His temperature was 99.8° and pulse 120, and he was tender in the right iliac fossa. The same day I removed his appendix, which was long and inflamed. Nothing else appeared wrong, though in view of the pathological appendix I did not make a search. His temperature fell to 98.4° the next day. He was happy, free from pain, ate his meals, had his bowels open, and was apparently convalescent.

On June 29—the seventh day after operation—his condition changed. His appetite went and he was fretful, but he did not complain of any sudden or serious abdominal pain. His bowels were open for the last time on that evening. The next day he began vomiting, he had absolute constipation to enemas, and his abdomen was tender to palpation. The wound was well healed. I did not think I could feel any definite abdominal mass. Some mucus was passed per rectum, but no blood.

On July 1 his abdomen was distended and there was visible peristalsis. I opened the abdomen again, and found a large, fairly tight enteric intussusception in the ileum, about a foot from the ileo-caecal valve. With a little difficulty it was reduced. The gut was viable. There was no Meckel's diverticulum. The next day his condition was excellent. He was happy again, began taking light diet, and his bowels were opened regularly. His convalescence since then has been uneventful.

The question arises: Could he have had the intussusception when I removed his appendix on June 22, or was it initiated by the abdominal manipulations? It was reducible and viable nine days after the initial operation.

I wish to thank Dr. Geoffrey Dudley for permission to report this case.

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Reviews

PHYSIOLOGY OF THE C.N.S.

Physiology of the Nervous System. By J. F. Fulton, M.D., Sterling Professor of Physiology, Yale University; formerly Fellow of Magdalen College, Oxford. Second edition. (Pp. 614. 38s.) London: Oxford University Press.

The appearance of the first edition of this book in 1938 marked an important phase in the current intensive study of the central nervous system, and was a most welcome addition to physiological literature. The second edition puts us still further in Prof. Fulton's debt, by bringing the subject well up to date, and introducing further improvements in the display of facts and figures.

Some of the chapters have been largely rewritten, and particular stress has been laid on the biochemical aspects of the subject, such as the significance of acetyl choline in relation to nerve transmission, and on the important developments of the method of following nerve impulses by recording the electrical variations from point to point. Important results of developmental research are incorporated, and also advances in our knowledge of cutaneous receptors, of the functions of the basal ganglia and parietal lobes. There is a chapter on conditioned reflexes by Dr. H. S. Liddell, which gives an account of interesting work on sheep, and in general somewhat modifies the point of view taken by the Pavlov school.

A remarkable feature of the book is the splendid bibliography: one would expect a good list of references from Prof. Fulton, but this one is quite exceptionally valuable. The general get-up of the volume is excellent.

HEALTH SERVICES

The Nation's Health. By Prof. J. M. Mackintosh. Target for Tomorrow No. V. (Pp. 64; illustrated. 4s. 6d.) London: The Pilot Press.

A series of books under the general title of *Target for Tomorrow* is being published under the supervision of Sir William Beveridge, Dr. Julian Huxley, and Sir John Boyd Orr. The fifth volume in this series, by Prof. James Mackintosh, in 64 profusely illustrated pages, tells the general reader a good deal of the story and breathes the spirit of a reformer more interested, perhaps, in the wider problems of the public health than in those that beset the private individual when he seeks the advice of his family doctor.

The very short chapters are successively entitled: "Health: the Problem"; "Doctor: Patient and Health Insurance"; "Hospital, Consultant and Nursing Services"; "Maternity and Child Welfare"; "Other Health Services"; "The Problem of Health Administration"; "Medical Research"; "In Other Countries"; "Health: Plans and Opinions"; "A Target for National Health." The short text is pithy and informative, and the author has evidently relied on photographs to fill in the gaps he has left. It is not always clear why he has chosen the pictures he has: for example, in the 4½ pages given to "Hospital, Consultant and Nursing Services," 2½ are occupied by reproductions of Florence Nightingale in the military hospital at Scutari, Lister in a King's College Hospital in 1893 (in a charmingly old-fashioned group), and of one of the latest and brightest wards in "an up-to-date public hospital run by the London County Council." A lay person will no doubt say to himself, "The public hospital has it." But the comparison, if a comparison is intended, is unfair. To give one whole page to a photograph of a small boy cleaning his teeth does not really throw much light on the dental services of the country or on the problem of dental caries, and to give 4½ pages to illustrating the Peckham Health Centre seems a little out of balance in a book of this size. On the other hand, a full-page view of an occupied bedroom in West Ham says more about the evils of overcrowding than any number of tables, charts, or verbal description: this picture tells a story and drives it straight home.

The author may have been writing against time, and his book was already drafted when the Government issued its White Paper in 1944: he must be congratulated on the skill with which he met this awkward situation and on the excellent and concise summary he gives of the Paper. But we doubt whether members of the